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SUBJECT: Provisions for On-Pad Emergency
Egress from CM: Current Status -
Case 330

DATE: January 4, 1966
FROM: P. R. Knaff
L. G. Miller

ABSTRACT

This memorandum describes the requirements for on-pad emergency egress of the flight crew and the extent to which this capability has been provided. Emergency egress is effected through the CM access arm. It was necessary to conduct an emergency egress demonstration utilizing a fully suited, 3-man crew in order to plan for emergency egress and to verify the compatibility of the recently redesigned access arm adapter hood with both Block I and Block II command modules. Demonstration of emergency egress from the Block I CM showed that exit times were compatible with current emergency egress plans. Certain mock-up design problems precluded the demonstration of emergency egress from the Block II CM.

The memorandum points out the necessity to reverify the exit times from the Block I CM under conditions which more closely match the planned hardware configurations. Secondly, the operational implications of the data obtained from the Block I demonstration are noted. Finally, future requirements for demonstrations and for information reporting are summarized.

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MEMORANDUM FOR FILE

Purpose

This memorandum describes the requirements for on-pad emergency egress of the flight crew and the extent to which this capability has been provided.

Background

A plan for on-pad emergency egress from the CM must be provided during the period bounded by spacecraft hatch close-out and space vehicle lift-off. If a malfunction were to occur during this period, there would be four alternatives available to the flight crew. Depending on the specific situation, they could:

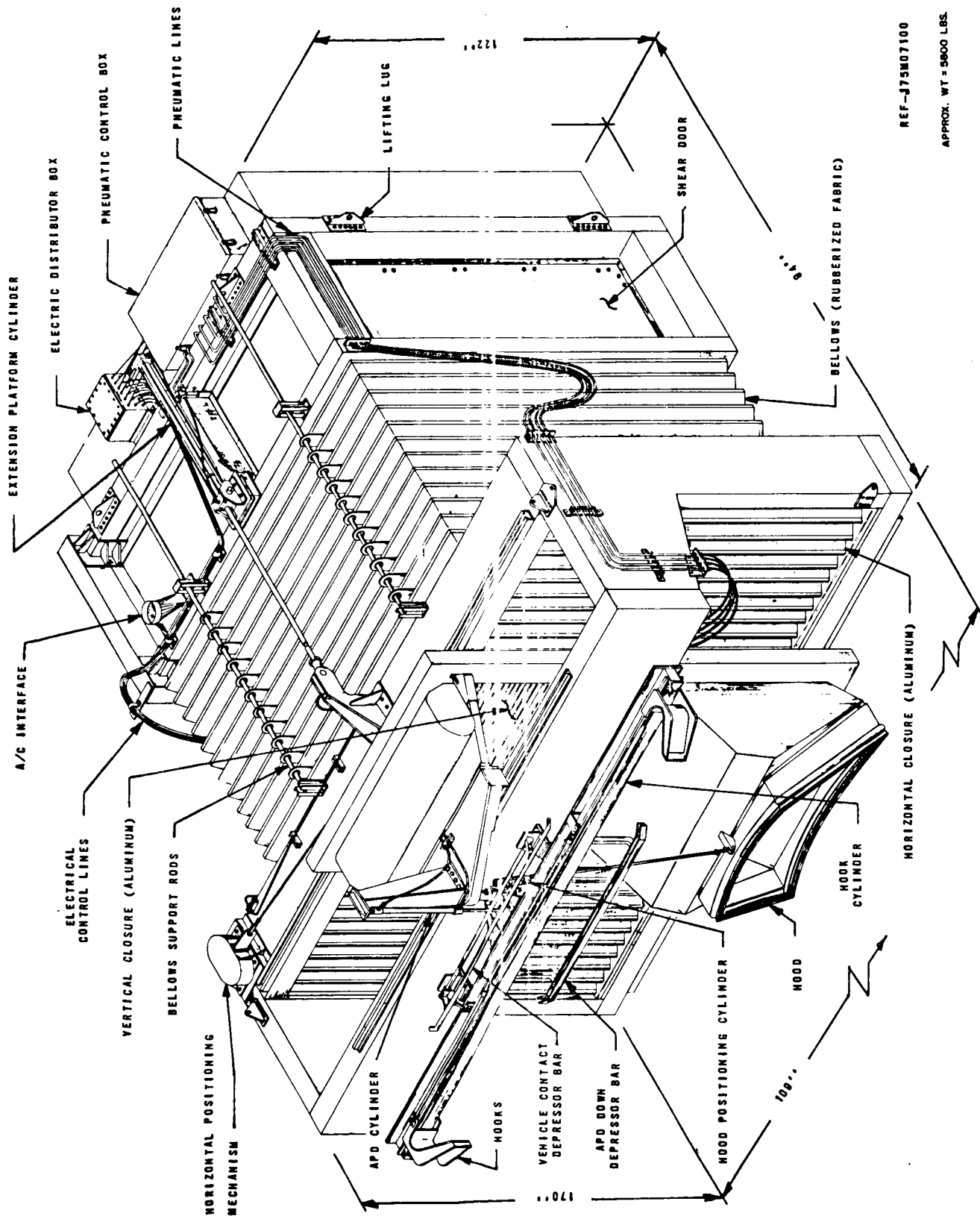
1. Remain in the spacecraft until the difficulty is resolved.
2. Use the launch escape system to effect an on-pad abort.
3. Have ground personnel return to the launch pad and assist with astronaut egress via the CM Access Arm.
4. Perform an unaided emergency egress via the CM Access Arm.

After the crew has entered the CM and hatch close-out has been accomplished, the access arm is rotated back against the umbilical tower and automatically latched in place. In case of an emergency, the arm must be capable of being rotated back into place in 30 seconds. The adapter hood (shown in Figures 1 and 2) must be positioned so as not to interfere with opening of the crew hatch on either Block I or Block II command modules.

The size of the crew hatch openings on Block I and Block II Apollo command modules is the same, but the Block II version has an outer hatch which is hinged on one side. There are no hinges on the Block I outer hatch. Recent action resulted in the design of a single adapter hood for use with both Block I and Block II command modules starting with AS 204.⁽¹⁾ In order to

(1) c.f. Apollo Inter-center Interface Control Document 65 ICD 8311 dated October 29, 1965.

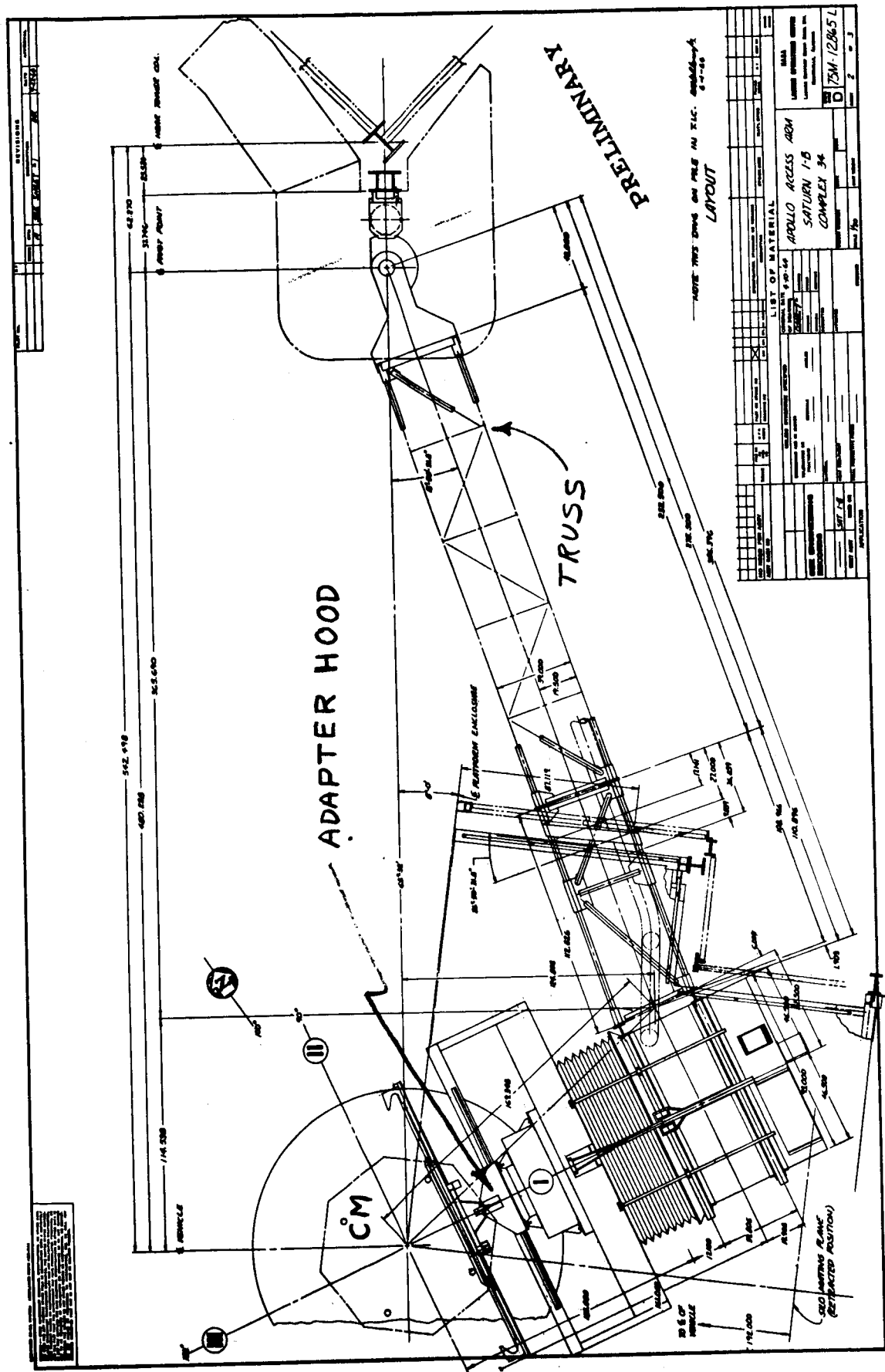
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Environmental Chamber
Figure 1



Apollo Access Arm, Complex 34
Figure 2

demonstrate the flight crews' ability to perform an unaided emergency egress, it was requested⁽²⁾ that Block I and Block II spacecraft mockups be provided, along with a CM access arm adapter hood. The demonstration was also to identify any design changes required for unassisted crew egress and establish time estimates for this operation. In late November, it was determined that the demonstration would be held in conjunction with a Block II Critical Design Review to be held during the week of December 13 at North American Aviation, Downey, California.

Conduct of Demonstration

For the demonstration, accurate Block I and II spacecraft mockups were to be provided including couches, a portable life support system (PLSS) mockup⁽³⁾, flight-weight and flight-configured doors⁽⁴⁾ including operating latches, and boost protective covers. An interim version of the CM access arm adapter hood, modified to permit its use with Block I and II CM crew hatches, was also to be available. Three suited astronauts were to duplicate the situation that will exist in the CM following hatch close-out and, on command, perform a simulated emergency egress. The times required to perform egress from both spacecraft configurations were to be recorded for use in planning pad emergency egress operational procedures. Of more specific interest on the Block I CM was the question of whether the ablative hatch and boost protective cover would come to rest in such a manner as to interfere with astronaut egress. In the Block II version, it was to be determined (a) whether the storage location of the PLSS would interfere with astronaut egress, and (b) whether the hinged ablative hatch presented any operational difficulties.

A demonstration of emergency egress from the Block I CM took place. It required 33 seconds for the first crew member to exist from the spacecraft; all three astronauts were out after 41 seconds had elapsed.

The times reported above represent approximations only. Exact data must necessarily await resolution of the following discrepancies, which were observed at the egress demonstration:

⁽²⁾Memorandum dated October 29, 1965, from CA/Assistant Director for Flight Crew Operations to PA/Manager, Apollo Spacecraft Program Office, Subject: "CM Block I and II Egress Demonstration."

⁽³⁾Present plans indicate that a PLSS unit will be stored in the CM in the vicinity of the hatch (Block II only).

⁽⁴⁾i.e., the inner pressure hatch and the ablative hatch.

1. The seals around the inner pressure hatch were not in place.
2. The latching mechanism on the boost protective cover was not configured for use with the Block II CM and could not be operated when installed on the Block I version.
3. A "hinge" arrangement, which is supposed to constrain the motion of the boost protective cover, was not used.
4. A fabric closure⁽⁵⁾ over the end of the adapter hood was not available.

No demonstration of unaided emergency egress from the Block II CM took place. This was due primarily to the fact that (a) the storage location of the PLSS unit, in conjunction with certain spacecraft structural features, would not allow installation of the inner pressure hatch and (b) the hinged ablative hatch had not been installed. It is understood that minor modifications to certain CM longerons⁽⁶⁾ are being considered in order to alleviate the PLSS interference.

Future Requirements



Even though there were a number of discrepancies associated with the Block I egress demonstration, it is felt that the data obtained is satisfactory for some planning purposes. Exit of the first crewman in approximately thirty seconds shows clearly that the current requirement for access arm reattachment in thirty seconds is a minimum requirement. It also highlights the need to specify that crew egress through the hatch be delayed until it is ascertained that the access arm is extended and properly positioned. Furthermore, it is necessary to delay opening of the outer hatch until the access arm is in position because: (1) In Block I, the prematurely opened hatch door would fall to the ground, and (2) in Block II, the hatch door, if opened too soon, might interfere with access arm attachment and might also result in hatch and CM deformation. It remains to obtain additional data for the Block II CM, a task which must necessarily await resolution of the PLSS storage problem.

(5) The cover serves to maintain environmental chamber (c.f. Figure 1) cleanliness when the CM access arm is retracted. It is installed following crew hatch close-out and could conceivably interfere with opening of the ablative (outer) hatch.

(6) These are interior structural members located near the side crew hatch.

Additionally, it is strongly suggested that, at a minimum, a mockup of the adapter hood and closure be available for use at any future emergency egress demonstration. Use of the actual adapter hood would be much more desirable, but delivery schedule considerations will probably preclude this.

The information contained herein is to be discussed at length at the next meeting of the Emergency Egress Working Group of ALOC to be scheduled for mid January, 1966. Provision has also been made for the findings of the Emergency Egress Working Group to be reported to the Apollo Saturn Crew Safety Panel early in March.


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